

DRAFT

**PARTICULATE MATTER
MONITORING NETWORK DESCRIPTION
FOR THE
MOUNTAIN COUNTIES
MONITORING PLANNING AREA**

PREPARED BY

Air Quality Data Review Section
California Air Resources Board

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1.0 INTRODUCTION

This plan provides a description of the PM_{2.5} and PM₁₀ ambient monitoring network designed for the Mountain Counties Monitoring Planning Area (MPA). Airborne particles with aerodynamic diameter less than 10 microns (PM₁₀) are small enough to be inhaled. The PM₁₀ includes fine particles with aerodynamic diameter less than 2.5 microns (PM_{2.5}) as a component. The deployment of the PM_{2.5} network is critical to the national implementation of the new PM_{2.5} National Ambient Air Quality Standards (NAAQS). The ambient data from this network will be used for designating areas as attainment or nonattainment, developing particulate matter control programs, and tracking the progress of such programs.

During the early stages of the PM_{2.5} network design process, the Air Resources Board (ARB) and the local air quality management districts established MPAs for the State. The entire State is covered by 18 MPAs. These MPAs will be used for planning monitoring locations for PM_{2.5}. They are not intended for designating areas as attainment or nonattainment or planning control measures. The U.S. Environmental Protection Agency (U.S. EPA) has not yet established the boundaries to be used for these purposes.

The proposed PM_{2.5} monitoring network for the Mountain Counties MPA includes seven monitoring sites. In most cases, the PM_{2.5} sites are located at the existing PM₁₀ sites. Each monitoring site will operate a PM_{2.5} Federal Reference Method (FRM) monitor and two of these sites also include a speciation monitor to further define the chemical composition of the PM_{2.5}. The individual monitors will be operated by one of the following agencies:

- ▶ Air Resources Board - 3 sites.
- ▶ Northern Sierra Air Quality Management District (AQMD) - 4 sites.

1.1. Physical Setting

The Mountain Counties MPA is the same as the Mountain Counties Air Basin. It includes Plumas, Sierra, Nevada, Amador, Calaveras, Tuolumne, Mariposa, and portions of Placer and El Dorado counties. It is located in the eastern portion of the Sierra Nevada Mountains incorporating much of what is the Sierra Foothills. Elevation varies from less than 1000 feet above sea level on the west to approximately over 6000 feet on the east.

1.2 Population Characteristics

The population of a Metropolitan Statistical Area (MSA) is one of the key parameters in determining the minimum number of required monitoring sites per the U.S. EPA PM_{2.5} regulations. The Mountain Counties MPA includes a portion of Sacramento Primary Metropolitan Statistical Area (PMSA). The population figures for this PMSA are listed in Table 1.5.1. The remainder of the MPA lies outside of MSA or PMSA boundaries. The counties included in the MPA are listed along with population figures in Table 1.2.1.

Table 1.2.1 Population in the Mountain Counties MPA by County

<u>County</u>	<u>Population (in 1990)</u>
Amador	31,316
Calaveras	34,387
El Dorado (P)	101,245
Mariposa	15,612
Nevada	82,950
Placer (P)	16,940
Plumas	20,595
Sierra	3,617
Tuolumne	49,064
Total Population	355,726

(P) - Portion of a county within the MPA

1.3 Climate and Weather

Winters are longer and more severe with elevation throughout this area. Usually, there is moderate to heavy snowfall over 4000 feet. The intensity of the winter increases decidedly with elevation and isolation from the ocean. The summers are generally mild to warm over the region.

1.4 Dominant Economic Activities and Emission Sources

From the ARB 1995 updated emission inventory, the total estimated PM2.5 emissions for Mountain Counties are 51.1 tons per day. The sources responsible for the PM2.5 emissions in the Mountain Counties MPA are listed in Table 1.4.1.

Table 1.4.1 PM2.5 Emission Inventory for Mountain Counties

Category	Sources	Source Contribution (tons per day)
Geologic	Unpaved Road Dust	11.86
	Construction	3.22
	Farming Operations	0.15
	Paved Road Dust	1.37
	Fugitive Windblown	0.19
	Subtotal	16.79
Mobile	Mobile Sources	1.85
	Subtotal	1.85
Industrial	Industrial & Other	1.88
	Fuel Consumption	1.97
	Subtotal	3.85
Burning	Waste Burning	7.91
	Residential Wood Burn	14.72
	Wildfires & Fires	5.82
	Subtotal	28.45
Other	Miscellaneous Processes	0.19
	Subtotal	
Total		51.1

1.5 PM2.5 Monitoring Requirements

Based upon the U.S. EPA PM2.5 regulation, all Metropolitan Statistical Areas with population greater than 200,000 are required to have a core PM2.5 SLAMS (this is a site in a populated area representing PM2.5 concentrations on a neighborhood or urban scale). The required number of core SLAMS and the sampling frequency is determined by the 1990 census population statistics for each MSA. The greater the population in an MSA, the more monitoring sites required for that area. One additional core PM2.5 monitor sampling everyday is required for each Photochemical Assessment Monitoring Station (PAMS) area included in the MPA.

The Mountain Counties MPA includes a portion of the Sacramento PMSA. The Sacramento PMSA has a population level that requires PM2.5 monitors but the population density varies greatly within the PMSA. The highest population density area lies outside of the Mountain Counties MPA. Consequently, the monitoring requirements for this PMSA were taken to apply to areas in the PMSA with higher population density and not to the Mountain Counties MPA. There are no PAMS areas in the Mountain Counties MPA.

The regulation also requires a PM2.5 monitor for every 200,000 people living either outside of an MSA or in MSAs with fewer than 200,000 people. These additional sites are supposed to sample for PM2.5 once every three days. In the Mountain Counties MPA, there were 355,726 people living outside of MSAs or in an MSA with fewer than 200,000 people. At

a minimum, 2 additional sites are needed to satisfy the requirement for PM2.5 monitoring within this outlying area. However, more sites will be deployed than the minimum number required in an effort to provide better coverage.

Table 1.5.1 identifies the number of core PM2.5 monitoring sites to be operated within the Mountain Counties MPA.

Table 1.5.1 Required and Planned Core PM2.5 Monitoring Sites

MSA/PMSA/County	Population in 1990	Required Core PM2.5 Monitoring Sites		Planned PM2.5 Sites
		Everyday Sampling	1 in 3 day Sampling	
Sacramento PMSA (P)	118,185	3*	1*	0
Amador County	31,316	0	2	1
Calaveras County	34,387	0		1
Mariposa County	15,612	0		1
Nevada County	82,950	0		2
Plumas County	20,595	0		2
Sierra County	3,617	0		0
Tuolumne County	49,064	0		0
	355,726	3	3	7

(P) Portion of the Sacramento PMSA within the Mountain Counties MPA

* The Mountain Counties portion of the Sacramento PMSA is relatively small and sparsely populated. Total population in the Sacramento PMSA was 1,340,010 compared to 118,185 in the Mountain Counties portion of PMSA. Consequently, the monitoring requirements for this PMSA were taken to apply to areas in the PMSA with higher population density and not to the Mountain Counties MPA.

2.0 PM2.5 MONITORING NETWORK ELEMENTS

This section summarizes PM2.5 monitoring sites planned for deployment in 1998 and 1999. In most cases, the existing particulate matter monitoring sites will be used for the additional PM2.5 monitoring. The existing particulate matter data have assisted in the design of the PM2.5 network by providing information on the trends and the magnitude of concentrations. These data will be valuable in the future in understanding the particulate size distributions of emission sources and developing control strategies. Therefore, the particulate matter monitors currently operating at the sites selected for PM2.5 monitoring are also summarized in this section.

Refer to Section 2.0 in the California Particulate Matter Monitoring Network Description for a summary of particulate matter monitoring outside of the PM2.5 monitoring network

2.1 PM2.5 Monitors Planned for Deployment

The planned PM2.5 monitoring network will collect data for multiple objectives, including:

- (1) Comparing sampling results with the PM2.5 NAAQS to determine attainment/nonattainment status.
- (2) Developing and tracking implementation plans for the area.
- (3) Assisting health studies and other ambient aerosol research activities.

In order to understand the nature of the PM2.5 problem in the Mountain Counties and to develop control strategies, multiple monitor types will be needed. The PM2.5 Federal Reference Method (FRM) sampler is a gravimetric filter-based sampler that produces a concentration measurement of PM2.5 over a 24-hour period. The FRM alone cannot support multiple information needs of the PM2.5 network. The sampler design includes a Teflon filter that can experience a loss of volatile constituents, which can be captured and retained better by other sampling techniques. In addition, it does not provide temporally resolved data or full chemical characterization of ambient aerosols.

In addition to FRM monitors, two other types of instruments are required for deployment as part of the PM2.5 network: speciation samplers and continuous mass monitors. Speciation samplers provide a chemical characterization of ambient aerosols for developing emission mitigation strategies and for tracking the success of implemented control programs. Continuous PM2.5 mass monitors will collect data for public reporting of short-term concentrations, for understanding diurnal and episodic behavior of fine particles, and for use by health scientists investigating exposure patterns. However, currently available instruments for continuous measurements of suspended particulate mass have many shortcomings. The Tapered Element Oscillating Microbalance (TEOM) sampler uses a heated inlet causing evaporation of the volatile components of the air sample. The Beta Attenuation Monitor (BAM) which samples at ambient temperatures and relative humidities may overestimate particle concentrations by allowing liquid water to be collected along with particles. Currently there are no plans to deploy continuous

PM2.5 monitors in the Mountain Counties MPA.

The Mountain Counties MPA PM2.5 monitoring network will consist of seven monitoring sites. Five of these sites will be deployed in 1998 and two in 1999. Each site will operate FRM samplers purchased through the National PM2.5 Sampler Procurement Contract established by the U.S. EPA. One of these monitoring sites in the MPA will operate collocated samplers for quality assurance and quality control evaluation.

PM2.5 speciation samplers are proposed for two sites in 1999. Table 2.1.1 lists the monitoring sites and the type of instruments planned at these sites.

Table 2.1.1 PM2.5 Monitoring Network Planned for Deployment

Site Location	AIRS Site ID	PM2.5 FRM	PM2.5 Speciation	PM2.5 TEOM/BAM	Other PM2.5 Monitor
Grass Valley-Litton Building Site	060570005	X			
Portola	060631008	X	Y		
Quincy-N Church Street	060631006	X			
San Andreas-Gold Strike Road	060090001	X			
Truckee-Fire Station	060571001	XX	Y		
Jackson-Clinton Road	060050002	Y			
Yosemite Village	060431001	Y			

Codes:

- X Monitor to be deployed in 1998
- Y Monitor to be deployed in 1999
- XX Collocated particulate monitors used for precision data to be deployed in 1998
- YY Collocated particulate monitors used for precision data to be deployed in 1999

2.2 Existing Particulate Matter Monitors

The existing particulate matter network in the Mountain Counties MPA consists of ten monitoring sites. The monitoring instruments operating at these sites include:

- ▶ 9 High Volume Size Selective Inlet (SSI) samplers collecting 24-hour PM10 samples.
- ▶ 1 dichotomous sampler collecting 24-hour fine fraction (≤ 2.5 microns in diameter) and coarse fraction (> 2.5 and ≤ 10 microns in diameter) sample.
- ▶ 3 continuous mass samplers collecting PM10 measurements hourly, using either a Tapered Element Oscillating Microbalance (TEOM) sampler or Beta Attenuation

Monitor (BAM) sampler.

All of the proposed PM2.5 sites will be located at the existing PM10 sites. Table 2.2.1 summarizes the particulate matter monitoring resources available at the proposed PM2.5 monitoring sites. The complete summary of particulate matter monitoring resources in the Mountain Counties can be found in Attachment 1 in the statewide summary.

The particulate matter data obtained from these sites are used to meet the following objectives:

- ▶ Compare measured concentrations to the State and national PM10 standards.
- ▶ Track changes in the particulate matter concentrations over time.
- ▶ Evaluate the population exposure.
- ▶ Assess the impact from transported particulate matter.
- ▶ Assist in health studies and other research.
- ▶ Manage the agricultural burning program in the Mountain Counties.

2.3 PM2.5 Quality Assurance

The agencies operating PM2.5 monitors in the Mountain Counties MPA will adopt a schedule for implementing quality assurance procedures developed by the ARB. Please refer to Section 3.7 in the statewide summary for more information about the schedule.

2.4 Laboratory Analyses

The FRM instruments collect PM2.5 over 24-hour periods on Teflon-membrane filters from air drawn at a controlled flow rate through a tested PM2.5 inlet. Within 96 hours after the sample collection period, the filter contained in the filter cassette will be removed from the sampler and placed in a protective container. During the period between filter retrieval from the sampler and the start of conditioning, the filter will be maintained at a temperature below 25 degrees centigrade. The filters will be transported to the ARB Monitoring and Laboratory Division in Sacramento. The filters containing PM2.5 samples will be “conditioned” and weighed at the laboratory.

Samples collected from the speciation monitors will be analyzed by a nationwide network of 1 to 3 laboratories. These laboratories will be working under contract performing the necessary laboratory analyses. The establishment of this network of laboratories is still under development with the specific laboratories yet to be determined.

Table 2.2.1 Existing Particulate Matter Monitors at Proposed PM2.5 Sites

Site Location	AIRS Site ID	Dichot	PM10 SSI	PM10 TEOM/BAM	Other PM Monitors
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Grass Valley-Litton Building Site	060570005			X	
Portola	060631008	X	X		
Quincy-N Church Street	060631006		X		
San Andreas-Gold Strike Road	060090001		X		
Truckee-Fire Station	060571001		X	X	
Jackson-Clinton Road	060050002				
Yosemite Village	060431001		X		

Codes:

X	Existing monitor
COH	AISI Tape Sampler for soiling index (coefficient of haze)
Neph	Light Scatter (nephelometer)
SSI	High Volume Size Selective Inlet Sampler collecting 24-hour PM10 samples
Dichot	Dichotomous sampler collecting 24-hour fine fraction and coarse fraction samples
TEOM	Tapered Element Oscillating Microbalance collecting PM10 measurements hourly
BAM	Beta Attenuation Monitor collecting PM10 measurements hourly
Dry Dep	Dry deposition (gases and particulate matter)

3.0 PM2.5 MONITORING SITES TO BE DEPLOYED IN 1998

During 1998, five PM2.5 monitoring sites are planned for deployment in the Mountain Counties MPA. This section discusses the criteria used in the selection of the five PM2.5 monitoring sites along with the important parameters that characterize each site.

3.1 Monitor Siting

The existing particulate matter network in the Mountain Counties MPA consists of ten sites. During the PM2.5 site selection process the following factors were evaluated:

- ▶ Population statistics and distribution.
- ▶ Land use characteristics.
- ▶ Local climate.
- ▶ Suspected area emission sources (wood smoke, agricultural burning, etc.).
- ▶ Existing particulate matter monitoring network.
- ▶ Existing particulate matter data, including data collected by the dichotomous network, PM10 network, and special studies.
- ▶ Potential transport corridors.
- ▶ Ongoing special health studies.

After the review process it was determined that existing PM10 sites would be well suited as locations for monitoring PM2.5. Only one of the PM2.5 sites will be located at a new particulate matter sampling location. All sites selected to operate PM2.5 samplers are located in populated areas where high PM2.5 concentrations are expected. These sites should provide useful information about PM2.5 transport, emission sources, and population exposure.

3.2 Site Description

The network for the Mountain Counties MPA, as proposed, includes 5 sites that will be deployed in 1998. The following characteristics apply to all of the proposed sites:

- ▶ Use a Federal Reference Monitor (FRM) type sampler purchased through the National Contract established by the U.S. EPA.
- ▶ Sited in a population-oriented location.
- ▶ “Site Type” is Core SLAMS.
- ▶ Represent neighborhood spatial scale.
- ▶ Provide data that will be compared to both the annual standard and the 24-hour standard.

Based on these criteria, the following sites listed in Table 3.2.1 are identified for use for PM2.5 monitoring within the Mountain Counties MPA.

Many of the monitoring sites in the Mountain Counties MPA will serve multiple purposes.

The monitoring sites at Portola and San Andreas-Gold Strike Road will be used to represent areas of maximum PM_{2.5} concentrations with high population density. The other three sites are intended to be representative of poor air quality in an area of high population density. They may not necessarily be in an area of expected maximum concentrations. The monitoring sites at Grass Valley-Litton Building Site and San Andreas-Gold Strike Road will collect data meteorological and PM_{2.5} data for assessing transport of PM_{2.5} into the Mountain Counties MPA.

The monitoring objectives at each of the monitoring sites in the Mountain Counties MPA will be further evaluated during the next year's annual network when PM_{2.5} data will be available from these sites.

Table 3.2.1 PM_{2.5} Monitoring Sites to be Deployed in 1998

Site Location	AIRS Site ID	Operating Agency	Spatial Scale	Monitoring Objective	Site Type	Measurement Method
Grass Valley-Litton Building Site	060570005	NSI	Neighborhood	R,T	C	FRM/SCH
Portola	060631008	NSI	Neighborhood	M	C	FRM/SQ
Quincy-N Church Street	060631006	NSI	Neighborhood	R	C	FRM/SQ
San Andreas-Gold Strike Road	060090001	ARB	Neighborhood	M,T	C	FRM/SCH
Truckee-Fire Station	060571001	NSI	Neighborhood	R	C	FRM/SQ

The following codes are used in this table:

Operating Agency:

ARB California Air Resources Board
 NSI Northern Sierra AQMD

Monitoring Objectives:

R Represent high concentrations in a populated area.
 M Determine the highest concentration expected to occur in the area covered by the network (more than one site per area may be needed).
 T Determine the extent of regional pollutant transport.

Site Type:

C Core SLAMS
 S non-core SLAMS
 P Special Purpose Monitors

Measurement Method:

FRM/SCH Federal Reference Method Single Channel Sampler
 FRM/SQ Federal Reference Method Sequential Sampler

4.0 PM_{2.5} MONITORING SITES TO BE DEPLOYED IN 1999

There are plans to establish additional PM_{2.5} monitoring sites in 1999 that would operate

FRM monitors. The PM_{2.5} data from these sites are intended to help better define the boundaries of nonattainment areas and satisfy other monitoring objectives of the PM_{2.5} monitoring network. There are plans to deploy two PM_{2.5} chemical speciation monitors in 1999.

4.1 Monitoring Sites Operating PM_{2.5} FRM Monitors

There are plans to deploy two additional PM_{2.5} FRM monitoring site in the Mountain Counties MPA in 1999. One of these sites will be located at the existing PM₁₀ site at Yosemite Village. The other site will be located at the existing monitoring site at Jackson-Clinton Road, which currently operates gaseous monitors. The PM_{2.5} data collected at these site will be used to determine the boundaries of PM_{2.5} national attainment/nonattainment.

Table 4.1.1 PM_{2.5} Monitoring Sites to be Deployed in 1999

Site Location	AIRS Site ID	Operating Agency	Spatial Scale	Monitoring Objective	Site Type	Measurement Method
Jackson-Clinton Road	060050002	ARB	Neighborhood	R	C	FRM
Yosemite Village	060431001	ARB	Neighborhood	M	C	FRM

ARB California Air Resources Board

R Represent high concentrations in a populated area.

C Core SLAMS

FRM Federal Reference Method sampler

4.2 PM_{2.5} Chemical Speciation Sampling

The basic objective of the PM_{2.5} chemical speciation sampling and analysis program is to develop seasonal and annual chemical characterization and distribution, across the country, of the ambient aerosols present in PM_{2.5} samples. These chemically resolved data will be used to perform source attribution analyses, evaluate emission inventories and air quality models, and support health related research studies.

The EPA recognizes that sampling for chemical speciation is a developing science, and encourages creative approaches to chemical speciation sampling. The ARB and the local air quality management districts will evaluate existing chemical speciation samplers and select the best-suited instruments for the monitoring conditions in the Mountain Counties. The selected instrument will collect samples for the currently targeted chemical analytes, that include the following:

- ▶ Cations: particulate ammonium, ionic sodium, calcium, and magnesium.
- ▶ Anions: particulate sulfate, nitrate, and chloride.
- ▶ Carbon: total, organic, and elemental.
- ▶ Trace elements: sodium, magnesium, etc., through lead.

- ▶ Semi-volatile organic particles.

The sites listed in Table 4.2.1 below were selected for collecting chemically speciated data because they best meet the following list of criteria in the order of importance:

- ▶ High PM2.5 concentrations, or expected significant contribution of PM2.5 to high PM10 concentrations.
- ▶ Located in a area of significant population density.
- ▶ Supports the agricultural burning program in the Mountain Counties.
- ▶ Located in PAMS areas where there is a maximum precursor site for PM2.5 (this may also be a high concentration site).
- ▶ Significant for atmospheric transport determinations.
- ▶ Geographical representation of a monitored area.

Table 4.2.1 PM2.5 Chemical Speciation Sampling

PM2.5 Chemical Speciation Site	AIRS Site ID	Operating Agency	Monitoring Method
Portola	060631008	NSI	to be determined
Truckee-Fire Station	060571001	NSI	to be determined

NSI Northern Sierra AQMD

4.4 Continuous PM2.5 Monitoring

The Federal regulation 40 CFR 58, Appendix D, 2.8.2.3, requires that continuous PM2.5 samplers be placed in metropolitan areas where there is a population greater than 1 million people. Continuous PM2.5 data are useful for public reporting of short-term concentrations, for understanding diurnal and episodic behavior of fine particles, and for use by health scientists investigating exposure patterns. The Mountain Counties MPA, with a population of 355,726 based on the 1990 census, is not required to have a continuous PM2.5 monitor.

5.0 SAMPLING FREQUENCY

The U.S. EPA requirements call for everyday sampling of PM_{2.5} at certain core SLAMS sites and one in three day sampling at all other PM_{2.5} and all PM₁₀ sites. In order to collect sufficient data and at the same time conserve monitoring resources, the ARB and the local air quality management districts are proposing alternative sampling frequencies for PM_{2.5} and PM₁₀.

5.1 PM_{2.5} FRM Sampling Frequency

Everyday sampling is not required at any of the seven sites in the Mountain Counties MPA as specified in the regulations, i.e., two sites per area over 500,000 population and one site per PAMS area. All core PM_{2.5} monitoring sites are required to collect a sample once every three days. Of the monitoring sites established in 1998, three sites will operate on a one-in-three-day schedule and two will operate on a one-in-six-day schedule. During the 1999 annual network review the ARB and the local air quality management agencies will propose sampling schedule for monitoring sites established in 1999.

The ARB and the local air quality control agencies will re-evaluate the sampling schedule during the annual network review next year. Monitoring sites with PM_{2.5} concentrations above the 24-hour standard will be considered for more frequent sampling.

Table 5.1.1 PM_{2.5} FRM Sampling Frequency

Site Location	AIRS Site ID	Operating Agency	Sampling Frequency	
			Required	Proposed
Grass Valley-Litton Building Site	060570005	NSI	1 in 3 day	1 in 6 day
Portola	060631008	NSI	1 in 3 day	1 in 3 day
Quincy-N Church Street	060631006	NSI	1 in 3 day	1 in 3 day
Truckee-Fire Station	060571001	NSI	1 in 3 day	1 in 3 day
San Andreas-Gold Strike Road	060090001	ARB	1 in 3 day	1 in 6 day
Jackson-Clinton Road	060050002	ARB	1 in 3 day	to be determined
Yosemite Village	060431001	ARB	1 in 3 day	to be determined

ARB California Air Resources Board
NSI Northern Sierra AQMD

5.2 PM2.5 Chemical Speciation Sampling Frequency

The federally required sampling frequency for PM2.5 chemical speciation is once in 12 days. This sampling frequency may not be sufficient in some cases to adequately support plans to control PM2.5 emission sources. The appropriate sampling frequency will be determined at a later date and will depend largely on PM2.5 data needs and available resources.

5.3 PM10 Sampling Frequency

The new U.S. EPA minimum requirement for PM10 sampling frequency is once every three days. The Air Resources Board and the local air pollution control districts in California are requesting that the U.S. EPA Region 9 grant a statewide waiver allowing sampling at the current schedule of one-in-six-days, with certain exceptions to be determined on a case-by-case basis. To demonstrate changes in the attainment status for the national 24-hour PM10 standard, more frequent sampling may be needed. Monitoring sites with maximum 24-hour concentrations close to the 24-hour standard may be required to sample everyday or at least on a one-in-three-day schedule.

[To Reviewers:

There is a need to determine if any of the monitoring sites in a given jurisdiction need sampling on a more frequent basis. This should be done by the operating agencies in the area. If a district is planning to sample more frequently because of sites with concentrations that are near the 24-hour-average NAAQS, these site locations should be listed below along with a proposed PM10 sampling frequency or this information should be communicated in another way to the ARB/TSD. For those areas in which the annual standard is the controlling standard, the minimum sampling schedule for all monitors in the area will be one-in-six-day.]